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(73) Proprietor: **United States Surgical Corporation**  
**Norwalk, Connecticut 06856 (US)**

(72) Inventor: **Aranyi, Ernie**  
**Easton, CT 06612 (US)**

(74) Representative: **Marsh, Roy David et al**  
**Hoffmann Eitle & Partner**  
**Patent- und Rechtsanwälte**  
**Postfach 81 04 20**  
**81904 München (DE)**

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**EP-A- 0 380 874** **DE-U- 8 900 376**  
**DE-U- 8 903 782** **US-A- 3 101 715**  
**US-A- 4 712 545**

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## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to endoscopic surgical instruments, and more particularly relates to an endoscopic instrument having reciprocating jaw members which pivot in response to the opening and closing of a handle member, where the movement of the handles is translated through an elongated tubular body member to open and close the jaw mechanism.

The present invention further provides a device in which the jaw mechanism may comprise cutting scissor blades, a gripping device for holding tissue during surgery, holding surgical needles and the like. The device of the present invention may be provided with a rotatable tubular body for selectively positioning the angle at which the jaw mechanism operates, and provision is also made for the use of electrocautery capabilities to provide for cauterization at the surgical site.

#### 2. Discussion of the Prior Art

In the prior art, various endoscopic surgical instruments are disclosed which utilize generally complex mechanisms for opening and closing handle members and jaw members to facilitate use of the device at a surgical site. Many devices provide an intricate construction in which a linkage mechanism for opening and closing the jaws requires numerous moving parts, while a sliding arrangement is provided between two extended rod members which activates the linkage mechanism in response to movement of the handle members. In addition, pivoting of the handle members in many cases causes an unwanted radial torquing force on the rod which requires additional space to be provided in the handle members to accommodate the radial movement of the rod.

Endoscopic devices presently in use include many devices having an interchangeable shaft assembly and jaw mechanism in which a common handle may be used with a series of instruments. However, these devices suffer disadvantages in that the connecting mechanism oftentimes obstructs the view of the surgeon, and the integrity of the device is decreased due to loosening of the connection. These disadvantages are critical due to the fact that an endoscopic surgical procedure requires precision instruments with tolerances that are carefully monitored. As the connections wear, precision is sacrificed, and the usefulness of the tool is diminished.

Greenberg, U.S. Patent No. 4,674,501 discloses a surgical instrument having a pair of reciprocating shafts which are provided with a rotational indexing knob in which the shafts are allowed to rotate to position a cutting tool at a specific angle to the handles. The shafts slide on top of each other in response to opening and

closing of the handle members to open and close the jaw members of the cutting instrument. The housing is secured to a stationary handle, such that the shaft assembly rotates with the indexing knob. One shaft is secured in a ball and socket joint to a movable handle which facilitates the sliding arrangement of the movable shaft over a stationary shaft. The handle assembly is disengagable from the housing by means of a screw, and the ball joint slides out of the socket to remove the handles. This type of device is subject to the disadvantage disclosed above, in which the integrity of the device is compromised due to the number of moving parts, as well as to the fact that the ball and socket joint is an inherently loose connection which will deteriorate during continued use.

Ger, U.S. Patent No. 4,919,152, discloses a clip applying device having a stationary handle and a pivoting handle to which an elongated shaft arrangement is attached. At the end of the shaft is a pair of reciprocating jaw members which are operated in response to pivoting movement of the handles. An inner shaft member is attached to the pivoting handle, the shaft member passing through an outer tube member which is attached to the stationary handle. As the rod member passes through the stationary handle, as well as through the outer tube at the location it is attached to the stationary handle, radial movement of the rod within the outer tube must be accounted for since the rod is attached to the stationary handle at a non-movable point. In relation to this, the bushing member is necessary inside the stationary handle to accommodate the radial play in the rod member during opening and closing of the handles.

Straub et al., U.S. Patent No. 4,590,936, discloses a microsurgical instrument having a complex gear mechanism for translating movement of the handles to an opening and closing movement of the jaw members. A helical slot is provided in a shaft member which allows a pin to move through the slot to move the jaw members. Furthermore, a ball and socket joint is provided in the movable handle to connect the movable handle to the inner rod.

Bauer, U.S. Patent No. 4,128,099, discloses a forceps device having an attachment for cauterization which conducts current through the outer tube to the jaw mechanism. A complex insulation system is provided to insulate the handle from the shaft, as well as to insulate the shaft itself. This device suffers the disadvantage that in order to insulate the handle, the rod member is secured to an insulating bushing, and a second rod is provided to the bushing to connect to the handle members. Furthermore, the connection point for the electrical connector is positioned in an area which will obstruct the view of the surgeon as he looks down the device to a surgical site.

An instrument in accordance with the pre-characterising part of claim 1 below is disclosed in DE-U-8 903 782.0.

DE-U-8 900 376 which is considered to represent

the closest prior art with respect to the present invention discloses an instrument with jaws closable at a distal end by relative proximal movement of a rod within a tube. Each jaw is pivotably attached at its proximal end to the distal end of the rod. Each jaw has a slot along its length and a pivot post extends transversely through the slot. During closing of the jaws, the distal end of the slot moves back towards the post.

The novel endoscopic surgical instrument pursuant to the present invention obviates the disadvantages encountered in the prior art and provides a precise instrument which is easy to manufacture and efficient to use, which eliminates many of the moving parts required by prior art devices. The instrument of the present invention incorporates many features which are of use to the surgeon during an operation, while it maintains a lightweight construction in an easy to handle device in which all the features may be operated with one hand. Furthermore, the features are so positioned so as to provide a maximum line of sight for the surgeon without obstructing the view to the surgical site.

### SUMMARY OF THE INVENTION

The present invention provides, as defined in claim 1 below, an endoscopic surgical device which incorporates many features necessary for an endoscopic surgical procedure, and provides a lightweight and easy to use device which may be operated with one hand. The device is simple to manufacture, and may incorporate any one of a series of jaw mechanisms for various surgical procedures. The device is a high precision instrument in which many moving parts normally associated with such a device are eliminated, thus reducing instances of mechanical failure requiring expensive repair or ultimate destruction of the instrument.

The endoscopic surgical instrument of the present invention essentially consists of a handle assembly, an elongated body assembly, and a tool mechanism attached at a distal end of the body assembly remote from the handle assembly. The handle assembly includes a stationary handle and pivoting handle, whereby the body assembly is attached to the stationary handle assembly and extends therefrom. The body assembly consists of an outer tubular member and an inner rod member which coaxially passes within the outer tubular member. The rod member is attached to the pivoting handle, while the tube member is secured in a conventional manner to the stationary handle. Preferably, the outer tube is provided with a detent which cooperates with a boss on the interior of the stationary handle to lock the outer tube in place. As the pivoting handle moves, the rod member slidably reciprocates within the outer tube member.

Attached to a distal end of the body assembly is provided the tool mechanism which opens and closes in response to movement of the pivoting handle in relation to the stationary handle. The tool mechanism may comprise a pair of jaw members wherein one or both jaw

members open and close to perform various endoscopic surgical procedures. The jaw mechanism includes, but is not limited to, a scissor device, a dissecting device, a grasping device and the like.

In one embodiment the jaw mechanism is secured to the outer tubular member by means of a transverse post member which serves as a common pivot point about which both jaw members pivot. Each jaw member is provided with a camming portion which extends away from the pivot point, and consists of a cam slot which extends from the pivot point into the outer tube. The upper jaw is generally provided with a pair of spaced apart projections, each provided with a cam slot which transversely overlap each other. The lower jaw is also provided with a pair of extensions which are spaced apart a distance which is less than the space between the projections of the upper jaw member so that the lower projections pass between the upper projections. The lower projections are also provided with transverse overlapping slots which are positioned at an angle to the upper cam slots. The jaw mechanism is secured to the outer rod through the common pivot point.

The inner rod member is provided with a bearing surface, which typically comprises a post member which passes through and is engaged within the cam slots of both jaw members. As the pivoting handle is moved, the rod slides through the outer tube and causes the post member to bear on the camming slots to pivot the jaw members about the common pivot point to open the jaw members. Since the cam slots are at an angle to each other, movement of the post member through the slots pivots both jaw members as the post rides through the slots. As the rod reciprocates, the jaw mechanism opens and closes.

In order to prevent excessive forces from being applied to the jaw mechanism, the pivoting handle is provided with a pair of stop members which are positioned proximate the pivot point which secures the pivoting handle to the stationary handle, and about which the pivoting handle moves. The upper, or proximal stop member abuts a boss within the stationary handle to prevent the jaw mechanism from opening too wide, while a distal, or lower stop member abuts the stationary handle to prevent excessive forces from being applied to the jaw mechanism during closing. Accordingly, the application of force to the jaw mechanism may be regulated during design and manufacture by the interengagement of the stop members on the pivoting handle with the bosses on the stationary handle.

A novel preferred feature of the present invention is the provision of a second pivot point on the pivoting handle, to which the inner rod member is attached. As the handle pivots, the second pivot point rotates to allow the inner rod to move longitudinally in the outer tube with minimal radial deflection. This is an important feature of the present invention in that it reduces the radial wear on the inner rod and prevents weakening of the structure during long term use. In addition, it allows for a reduction of the required internal spacing between the

outer tube and the inner rod to result in a more compact and streamlined instrument. Furthermore, unwanted torquing forces are eliminated at the pivot point thus minimizing the possibility of mechanical breakdown of the instrument at the connection between the pivoting handle and the movable inner rod.

The present invention may also feature a connection port to provide the device with electrocautery capabilities. In this embodiment of the invention, a connection port is provided, preferably on the stationary handle on the side of the longitudinal axis opposite the finger grip portion. The connection port is positioned at an angle to the longitudinal axis, which is preferably less than 30° and in a preferred embodiment is approximately 9° to the longitudinal axis, and extends in a direction away from the body assembly. In this way, the surgeon's line of sight is unobstructed and provides a clear view to the surgical site. The connection port allows for the connection of a suitable jack member to be inserted into the device. Electrical connection between the port and the outer tube is provided by a leaf spring member which extends from the port area to the outer tube. The outer tube is provided with electrical insulation, preferably heat shrink tubing, which extends a substantial portion of the length of the outer tube. In this embodiment, the handle is molded of plastic material to provide electrical insulation to the user.

It is also contemplated that the electrical port connection may be provided adjacent the finger grip of the stationary handle, so that the jack member extends downwardly away from the device to insure an unobstructed line of vision for the surgeon. In this case, a leaf spring member extends from the port through the stationary handle to the outer tube to complete the electrical connection.

A further preferred feature of the present invention is the provision of a rotatable knob on the outer tubular member to allow the body assembly and the jaw mechanism to rotate to position the jaws at desired angles to the longitudinal axis during the surgical procedure. Preferably, the rotatable knob is secured to the outer tube and positioned in a slot which passes through the stationary handle, so that a surgeon may rotate the knob, and consequently the body assembly and jaw mechanism, through the use of his thumb while he is holding the stationary handle with his fingers. This frees the surgeon's other hand to simultaneously operate another instrument during surgery.

Preferably, the rotatable knob is secured to a bushing, which in turn is secured to the outer tube member. The bushing is provided with a polygonal cross-section, which corresponds to a boss member within the interior of the stationary handle. This allows for incremental rotation of the body assembly and jaw mechanism to desired angles to the longitudinal axis. Preferably, the bushing has a dodecahedral cross-section.

In the preferred embodiment, all the above features are incorporated into a single endoscopic surgical instrument, so that the instrument has electrocautery

and rotational capabilities. However, the instrument may be constructed without one or more of the features while still providing a lightweight precision instrument.

Accordingly, it is an object of the present invention to provide an endoscopic surgical instrument in which all the features may be used by a surgeon with one hand.

It is another object of the present invention to provide a lightweight endoscopic surgical instrument which provides a clear line of sight for a surgeon during a surgical procedure.

It is a further object of the present invention to provide an endoscopic surgical instrument which prevents the application of excessive forces to the working tool mechanism to prevent damage to the instrument, whether the tool mechanism is being opened or closed.

It is yet a further object of the present invention to provide an endoscopic surgical instrument in which tolerances between the inner slidable rod member which operates the jaws and the outer tubular member which holds the jaw mechanism are such that there is little or no radial deflection of the rod during longitudinal movement through the tube.

It is still a further object of the present invention to provide an endoscopic surgical instrument having a handle assembly in which a first pivot point is provided for pivoting the movable handle about the stationary handle and a second pivot point is provided which connects the movable rod member to the pivoting handle which allows for rotation of the second pivot point to prevent radial deflection of the rod during longitudinal movement.

It is yet another object of the present invention to provide an endoscopic surgical instrument having electrocautery capabilities in which the connection port for an electrical jack member is out of the line of sight of the surgeon during use.

It is still a further object of the present invention to provide an endoscopic surgical instrument having a rotatable body member and jaw mechanism in which the rotation may be accomplished by the surgeon while using one hand.

It is still another object of the present invention to provide an endoscopic surgical instrument having all the features above including a rotatable body assembly and jaw mechanism, electrocautery capabilities, and a rotatable pivot point for connecting the inner rod to the pivot handle to prevent radial deflection of the rod during longitudinal movement.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing objects and other features of the invention will become more readily apparent and may be understood by referring to the following detailed description of an illustrative embodiment of the endoscopic surgical instrument, taken in conjunction with the accompanying drawings, in which:

Fig. 1 illustrates a perspective view of an endoscopic surgical instrument in partial cutaway according to the present invention;

Fig. 2 illustrates an exploded perspective view of a handle of an endoscopic surgical instrument according to the present invention;

Fig. 3 illustrates a side cutaway view of an alternate embodiment of an endoscopic surgical instrument according to the present invention;

Fig. 4 illustrates a side cutaway view of a second alternate embodiment of an endoscopic surgical instrument according to the present invention;

Fig. 5 illustrates a side cutaway view of a handle of a preferred embodiment of an endoscopic surgical instrument according to the present invention;

Fig. 6A shows a top cutaway view of the tool mechanism of an endoscopic surgical instrument according to the present invention;

Fig. 6B illustrates a side cutaway view of the tool mechanism of Fig. 6A of an endoscopic surgical instrument according to the present invention;

Fig. 7 illustrates an exploded perspective view of an alternate tool mechanism of an endoscopic surgical instrument according to the present invention;

Fig. 8A illustrates a plan view of the upper member of a dissector mechanism for use with an endoscopic surgical instrument according to the present invention;

Fig. 8B illustrates a plan view of a bottom member of a dissector mechanism for use with an endoscopic surgical instrument according to the present invention;

Fig. 9 illustrates a partial cutaway side view of the dissector mechanism of Figs. 8A and 8B attached to the end of an endoscopic surgical instrument according to the present invention;

Fig. 10A illustrates a plan view of an upper member of a molded plastic grasper mechanism;

Fig. 10B illustrates a plan view of a bottom member of a molded plastic grasper mechanism;

Fig. 10C illustrates a side view of a member of a grasper mechanism;

Fig. 10D illustrates a plan view of an upper grasper member constructed of metal;

Fig. 10E illustrates a plan view of a bottom member of a grasper mechanism constructed of metal;

Fig. 11A illustrates a side view of a housing member of an endoscopic surgical instrument according to the present invention;

Fig. 11B illustrates a top cutaway view along lines A-A of Fig. 11A of a housing member of an endoscopic surgical instrument according to the present invention;

Fig. 12A illustrates a side partial cutaway view of a rotator knob for use in an endoscopic surgical instrument of the present invention;

Fig. 12B illustrates a front view of the rotatable knob of Fig. 12A;

Fig. 13A illustrates a side partial cutaway view of a

bushing member for use in an endoscopic surgical instrument according to the present invention;

Fig. 13B illustrates a front view of the bushing of Fig. 13A;

Fig. 14A illustrates a side view of a pivot bushing for use with an endoscopic surgical instrument according to the present invention;

Fig. 14B illustrates a front view of the pivot bushing of Fig. 14A;

Fig. 15A illustrates a side view of an open scissor mechanism in accordance with the present invention wherein only one jaw member pivots;

Fig. 15B illustrates a side view of the scissor mechanism of Fig. 15A in the closed position; and

Fig. 15C illustrates a top view in cross-section of the stationary pivot pin of the scissors in Fig. 15A and 15B.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now in specific detail to the drawings, in which like reference numbers identify similar or identical elements, Fig. 1 illustrates an embodiment of the endoscopic surgical instrument 10. In its simplest form, the device comprises a handle assembly 12 which consists of a stationary handle 14 and a pivoting handle 16. Extending from the handle assembly is a body portion 18 which comprises an outer tubular member 20 through which a slidable inner rod member 22 passes in coaxial relationship. The outer tube 20 is secured to the stationary handle 14, while the inner rod 22 is secured to pivoting handle 16 at rotatable connection point 26. Handle 16 pivots about pivot point 24 to move in relation to stationary handle 14.

Attached at a distal end of the body portion 18 is a tool mechanism 28, which essentially consists of a lower jaw member 30A and an upper jaw member 30B. The tool mechanism is connected to the body portion 18 at pivot point 32 and moves in a reciprocating manner about pivot point 32 through the provision of linkage mechanism 34. Linkage mechanism 34 will be described in greater detail below.

In use, as pivoting handle 16 pivots about pivot point 24 in relation to stationary handle 14, inner rod 22 reciprocatingly slides within outer tube 20 in response to the push or pull force at connection point 26. The function of connection point 26 will be described in greater detail below.

As rod 22 slides within tube 20, the linkage mechanism 34 is actuated to pivot jaw members 30A and 30B about pivot point 32 to open and close the members. Jaw members 30A and 30B may comprise scissors, dissecting jaws, or a grasping mechanism, or any other tool mechanism required for specific surgical procedures.

As best seen in Fig. 2, pivoting handle 16 is provided with a pair of stop members 36A and 36B which cooperate with boss members 38A and 38B, respec-

tively, to limit the rotational movement about pivot point 24 of the pivoting handle 16. The stop members are positioned on opposite sides of pivot point 24 so that when pivoting handle 16 is moved away from stationary handle 14, proximal stop 36A contacts boss 38A to limit the actual rotation of handle 16. When handle 16 is moved towards handle 14, distal stop 36B contacts boss 38B to limit the rotation of handle 16 in that direction. The stop members are provided to prevent the application of excessive forces on the tool mechanism during opening and closing of the surgical instrument. In this manner, the possibility of damage or destruction of the tool mechanism is greatly reduced or eliminated.

Turning now to Fig. 3, Fig. 3 illustrates a first alternate embodiment 10A of the endoscopic surgical instrument of the present invention. Instrument 10A is similar to instrument 10 except for the provision of an electrocautery connection to allow for cauterization of tissue at the surgical site during the surgical procedure. Stationary handle 14 is provided with a connection port 42 for the reception of an electrical jack member (not shown) for providing the necessary current to the tool. A leaf spring 44 electrically connects port 42 with outer tube member 20 which carries the electric current to the tool mechanism at the surgical site. The leaf spring is provided with a connection member 46 at the port 42 and a connection member 48 at the outer tube. The connection members essentially rely on the resiliency of the material which comprises the leaf spring, but of course may be any conventional electrical connection.

As the electrical charge is applied to the outer tube, it conducts along the outer tube to the tool mechanism, which in this instance is preferably a scissor device 50 or other tool mechanism such as cautery hooks, forceps, or the like. In order to protect the surgeon who is using the device from electrical shock, the handle is preferably constructed of a rigid plastic material which renders the device lightweight and electrically insulated.

In order to prevent electrical shock during use, an insulation member 40 is provided on outer tube 20, the insulation member preferably consisting of heat shrink tubing. Heat shrink tubing 40 passes into stationary handle 14 to prevent the possibility of electric shock.

While connection port 42 is shown as being attached to stationary handle 14 at the finger grip, it is also contemplated to position the connection port on top of the handle as shown and described below in relation to Fig. 5. The positioning of the connection port in the present invention is such so as to provide the surgeon with an unobstructed line of sight down body member 18 to view the surgical site at the tool mechanism 28.

Fig. 4 illustrates a preferred embodiment of the invention, in which the instrument 10B is provided with the electrocautery feature as well as having provisions for a rotatable body portion 18. As seen in Fig. 4, a slot 54 is provided in stationary handle member 14 which passes completely through the handle member. Positioned within the slot 54 is a rotatable knob 52 which is fixedly secured to outer tube 20 through the provision of

a bushing member 56. The rotatable knob 52 and bushing member 56 will be described in greater detail below.

Also as best seen in Fig. 4, inner rod member 22 is connected to pivoting handle 16 through the provision of a rotational bushing 58. Bushing 58 pivots during movement of pivoting handle 16 so that as rod member 22 is reciprocated within tube 20, the bushing member 58 rotates to minimize or eliminate any radial movement of rod 22, to insure that rod 22 moves in a longitudinal direction only. This alleviates excessive torquing forces on rod member 22 as well as unwanted excessive forces at the connection point 26 to prevent damage to the handle or the inner rod member 22. Another feature provided by this rotational bushing member 58, is that by greatly reducing or eliminating radial movement of rod member 22, exact tolerances between the outer tube 20 and the inner rod member 22 may be maintained, so that less spacing is required and the instrument may be made in a smaller size than conventional endoscopic instruments. In addition, by greatly reducing or eliminating the radial deflection, the precision of the instrument is greatly enhanced. The features of rotational bushing member 58 will be described in greater detail below.

Turning now to Fig. 5, stationary handle 14A and pivoting handle 16A are illustrated having the provision of a locking mechanism 64A and 64B. Fig. 5 shows handle member 14A in a side cutaway view, and is the preferred embodiment of the present invention. As clearly seen in this view, handle member 14A and handle member 16A are attached at pivot point 24 so that during opening and closing of the handle assembly, proximal stop member 36A contacts boss 38A to limit rotation of pivoting handle 16A away from stationary handle 14A. When the handles are moved towards each other, stop member 36B contacts boss member 38B to limit rotation in that direction. Locking mechanism 64A and 64B may be utilized to position the handles at various locations during the opening and closing procedure, which of course allows for the application of various closing forces on the tool mechanism at the distal end of the instrument.

Handle 14A is provided with a slot 54 which accepts the rotatable knob 52. In addition, a polygonal shaped boss structure 57 is provided in the handle which will accept the corresponding polygonal shape of bushing member 56 when the instrument is constructed. The cooperation between structure 57 and bushing 56 allows for the incremental rotation of the body portion 18, and consequently the tool mechanism 28 to position the tool mechanism at various points along the rotational path. The number of faces presented by boss structure 57 is equivalent to the number of faces on the polygonal cross-section of bushing 56. Preferably, each structure has 12 faces.

In addition, Fig. 5 illustrates the preferred location of the electrical port 60, that being at the top of handle member 14A positioned at an angle to the longitudinal axis of the instrument formed by the body portion 18.



Port 60 is preferably positioned at an angle of less than 30° to the longitudinal axis, and in its most optimal position, is positioned at 9° to the longitudinal axis. This affords the surgeon a clear line of sight down the longitudinal axis of the instrument to view the procedure at the surgical site. Port 60 accepts an electrical jack member through hole 61, and an electrical connection is made through the provision of a leaf spring member held in track 62 which connects the jack (not shown) with the outer tube member as seen at 63.

Figs. 6A and 6B illustrate the tool mechanism which consists of, for example, a scissor mechanism including scissor blades 72 and 74. In this embodiment, a housing member 66 is attached to outer tube 20, and the tool mechanism is attached to housing member 66. Housing member 66 is shown in detail in Figs. 11A and 11B, in which a radial hole 67 is provided to accept pivot pin 68 to allow the tool mechanism to pivot about pin 68 during opening and closing. Housing member 66 is provided with a longitudinal slot 70 which allows the jaw members which comprise the tool mechanism to open and close, as best seen in Figs. 11A and 11B.

As also shown in Fig. 6A, stiffening members 75 may be provided on scissor blades 72 and 74 which reinforce the blades and add strength to the blades. Stiffening members 75 allow for a very thin construction for blades 72 and 74, particularly at the distal end 77. Stiffening members 75 may comprise a detent or outwardly punched region whose addition to blades 72 and 74 bias the blades towards each other to enhance the shearing function of the blades. As the blades are made thinner, the resiliency of the blade material, preferably stainless steel, titanium, or a like metal, tends to decrease, and the provision of stiffening members 75 urges the blades 72 and 74 toward each other to maintain the efficiency of the cutting action. It is also contemplated that stiffening members 75 may comprise a built up region of material, or a layer of material fastened to the blades by adhesives, solder, or the like.

As best seen in Fig. 6B, scissor blades 72 and 74 are shown in the open position whereby the handle members (not shown) are in the open position, i.e., pivoting handle 16 is moved away from stationary handle 14.

As the handles move, inner rod member 22 slides through outer tube 20 towards jaw mechanism 28. As seen in Fig. 6B, scissor blades 72 and 74 are provided with cam slots 76 and 78, which slots accept a bearing post 80 which is attached to inner rod 22. As rod 22 moves, bearing post 80 slides within cam slots 76 and 78 to pivot blades 72 and 74 about stationary pivot point 68 to open and close the blades. When the blades open, the tail end of the blades pass through slot 70 in housing member 66 to allow the blades to open.

When handle members 14 and 16 are drawn towards each other, inner rod 22 slides away from the jaw mechanism and draws bearing post 80 towards the handle assembly. As this occurs, bearing post 80 slides in cam slots 76 and 78 to draw the blades closed.

Turning to Fig. 7, Fig. 7 illustrates an exploded perspective view of a dissector device which may comprise tool mechanism 28. In this embodiment, outer tube 20 is provided with a slot 21 which allows for the opening and closing of the dissector members. In this embodiment, housing member 66 is eliminated.

The dissector members 82 and 84 are provided with a cam slot arrangement similar to the device illustrated in Fig. 6B. Cam slot 86 is provided on upper dissector member 82, and cam slot 88 is provided on lower dissector member 84. In this embodiment, inner rod 22 is positioned within outer tube 20, while dissector members 82 and 84 are pivotably secured to outer tube 20 by means of pivot pin 68 which passes through hole 69 in tube 20. Rod 22 is secured to the cam slot arrangement through the provision of bearing post member 90. As rod member 22 is slid forward within tube 20, bearing post 90 slides in cam slots 86 and 88 to pivot the dissector members about pivot point 68 to open the members, and when the rod member 22 is slid away from the dissector mechanism, post 90 slides in cam slots 86 and 88 away from the dissector mechanism to draw the dissector members 82 and 84 into a closed position, as best seen in Fig. 9.

As also seen in Fig. 9, as the jaws close, the distal tips of the jaw members 82 and 84 contact each other before the ends nearest the pivot point contact each other. An angle of less than 6° is maintained at this point, and preferably 2°, to allow for progressive application of pressure at the jaws.

Figs. 8A and 8B illustrate the preferred embodiment of the dissector device, in which the body portion has a crescent shape to facilitate grasping and tearing tissue. The surface of the dissector members include serrations 98 which are provided for dissecting and tearing tissue during a surgical procedure. Overlapping projections 94 and 96, on which cam slots 86 and 88 are formed, allow the dissector mechanism to open and close without interfering with each other. The spacing between projections 94 is less than the spacing between projections 96, such that projections 94 fit within projections 96. Slot 21 is provided on outer tube 20 to allow the projections to pass outside the perimeter of tube 20 to allow the dissector mechanism to open and close.

Figs. 10A through 10E illustrate a grasping mechanism which may be used as the tool mechanism on the endoscopic surgical instrument of the present invention. Figs. 10A and 10B illustrate a cooperating pair of grasping members 100 and 102 which are provided with serrations 104 to facilitate the grasping and holding of tissue. In the embodiment shown in Figs. 10A and 10B, the body portions 100 and 102 are preferably constructed of a plastic material which is integrally molded about projection 106. As best seen in Fig. 10C, a post member 110 is provided about which the members 100 and 102 are molded. Projection 106 is provided with cam slot 108 and pivot hole 109 so that the grasping mechanism may be operated in a manner similar to that

previously described above in connection with the scissor mechanism and the dissector mechanism.

Figs. 10D and 10E illustrate the grasping mechanism of Figs. 10A through 10C except where the entire mechanism is constructed of metal, such as stainless steel, titanium, cast aluminum or the like. Projections 112 and 114 cooperate in a manner similar to that described above for the dissector device, where projections 112 are spaced greater than the distance between the projections 114 so that projections 114 may pass between projections 112 during opening and closing of the grasping device.

Turning now to Figs. 12 and 13, there is illustrated the rotatable knob 52 and bushing member 56 which are used in connection with the rotatable body portion to rotate the body portion and tool mechanism. Rotatable knob 52 is preferably knurled or provided with ridges 116 to allow for easy manipulation by the surgeon's thumb or fingers. Rotatable knob 52 is preferably hollow and includes a passageway 118 to allow the bushing member 56 to pass therethrough. Fig. 13A illustrates the bushing member as having a polygonal cross-section, such that it is provided with a series of faces 126 which cooperate with faces 125 on the rotatable bushing. The bushing extends outwardly from rotatable knob 52 (see Fig. 4), and faces 126 cooperate with boss structure 57 (see Fig. 5) to provide for incremental rotation of the body portion 18 to position the tool mechanism at various points along the rotational axis. Fig. 13B best illustrates boss member 124 which allows for connection and securement of the bushing to outer tube 20. Boss 124 fits into a groove or slot in tube 20 to secure the bushing and rotatable knob to outer tube 20. It is also contemplated that bushing 56 and rotatable knob 52 are constructed as a single integral unit. Knob 52 and bushing 56 are preferably constructed of plastic, so that insulation is provided during use of the electrocautery feature.

The positioning of the rotatable knob on the stationary handle allows the surgeon to use the endoscopic surgical instrument 10B with one hand, so that as the surgeon is holding the device he may rotate the knob with his thumb while keeping his other hand free to control the surgical procedure.

As the knob is rotated, the outer tube is rotated which in turn rotates pivot point 68, which consequently rotates the tool mechanism. Rotation of the tool mechanism causes rotation of the inner rod 22, which is accomplished within pivot bushing 58. Pivot bushing 58 is best illustrated in Figs. 14A and 14B and comprises a pair of discs 128 each having a post member 130 and a hole 132 formed therein for interengaging the discs with each other. Groove 134 is provided with a notch portion 136 which accepts the end of rod member 22 which is formed with a corresponding notch. This notch secures rod 22 in place for longitudinal movement, while at the same time allowing for rotational movement. As stated above, as handle member 16 pivots, bushing 58 rotates to greatly reduce or eliminate radial deflection of the rod

member within the tube. This alleviates the torquing forces on the rod and minimizes damage to the device after extended use.

Figs. 15A and 15B illustrate a further embodiment of the tool mechanism in accordance with the present invention.

Stationary scissors blade 140 is attached to movable scissors blade 142 about transverse stationary pivot pin 144. This transverse pin 144 is attached to housing member 66 through radial hole 67 as discussed above (see Figs. 11A and 11B). The present scissors embodiment utilizes a shearing motion of blades 140 and 142 in order to separate tissue. Arcuate cutting surfaces, 146 and 148 respectively, are formed on opposed vertical faces of the distal ends of blades 140 and 142 to better facilitate the shearing cutting action. In a particularly advantageous embodiment, a spring washer 150, see Fig. 15C, is provided to urge movable blade 142 against stationary blade 140. The urging force providing a better cutting action as the blades 140 and 142 shear against each other.

A transverse bearing post 152 is attached to inner rod 22 and adapted for reciprocal longitudinal motion within outer tube 20. A longitudinal slot 154 is provided in a proximal end of stationary blade 140 in an area proximal to and in longitudinal alignment with transverse pivot pin 144. Bearing post 152 interfits with slot 154 for longitudinal motion therein and serves to prevent pivotal motion of blade 140 about pivot pin 144.

An arcuate cam slot 156 is provided in a proximal end of movable blade 142 in an area proximal to transverse pivot pin 144. Bearing post 152 interfits within arcuate cam slot 156 and serves to translate the longitudinal motion of inner rod 22 relative to outer tube 20 into pivotal motion of blade 142 about pivot pin 144. Thus, in the embodiment shown in Figs. 15A and 15B, as transverse bearing post 152 moves distally from its proximal position, blade 142 is cammed open relative to blade 140 which remains in the same longitudinal plane as rod 22. Correspondingly, proximal motion of rod 22 causes bearing post 152 to cam blade 142 to a closed position as shown in Fig. 15B.

This embodiment is directed to a shearing scissors mechanism, however, other mechanisms such as, for example, graspers, dissectors, clamps etc. are contemplated.

The endoscopic surgical instrument of the present invention is a compact, lightweight and easy to use instrument incorporating many features required during endoscopic surgical procedures which allows the surgeon to use the instrument with one hand thus freeing his other hand for other purposes during the surgery. The present instrument overcomes many of the disadvantages encountered with prior art devices and provides a precision instrument which is easy to handle and simple to manufacture. While the invention has been particularly shown and described with reference to the preferred embodiments, it will be understood by those skilled in the art that various modifications in form



and detail may be made therein without departing from the scope and spirit of the invention. Accordingly, modifications such as those suggested above, but not limited thereto, are to be considered within the scope of the invention.

## Claims

### 1. An endoscopic surgical instrument comprising:

a handle assembly (12) including a stationary handle (14) and a pivoting handle (16);

a body assembly (18) including a pair of coaxial members (20, 22) attached at one end to said handle assembly, comprising an inner rod member (22) slidable in relation to an outer tube member (20), said rod member sliding in response to movement of said pivoting handle and terminating at a second end in a bearing surface (80); and

a tool mechanism (28) comprising a pair of tool members at least one of which is pivotably secured at a stationary pivot point (68) to a second end of said tube member:

wherein said pivoting tool member is provided with an elongate camming surface (76, 78) of a camming slot which is slidably engaged by said bearing surface of said rod member;

wherein movement of said pivoting handle slides said rod member in relation to said tube member, such that said bearing surface of said rod member slides lengthwise over said camming surface of said tool member to pivot said tool member to open and close said tool mechanism.

### 2. An instrument as claimed in claim 1 wherein the tool members are jaws.

### 3. An instrument as claimed in claim 1 or 2, wherein the pivoting handle is attached to the stationary handle at a pivot point (24).

### 4. An instrument as claimed in any one of the preceding claims, and including a rotatable cylindrically-shaped knob (52) positioned in a transverse slot (54) which passes through said stationary handle (14), said knob having a passage through which said tube (20) and rod (22) pass, said knob being secured to said tube; wherein rotation of said knob effects rotation of said tube, rod and tool mechanism.

### 5. An instrument according to any one of the preceding claims, wherein said camming surface of said tool mechanism comprises a slot (76, 78) in each of said reciprocating members, said reciprocating

members being pivotable about a common pivot point (68) secured to said outer tube.

### 6. An instrument according to claim 5, wherein said bearing surface (80) of said rod member comprises a post member which passes through said slots of said reciprocating members, such that said post member slidably contacts said reciprocating members within said slots to effect opening and closing of said reciprocating members.

### 7. An instrument according to claim 1, 2, 3 or 4, wherein said camming surface comprises a slot in a first one of said reciprocating members, a second one of said reciprocating members being stationary such that said first member pivots in relation to said second member.

### 8. An instrument according to claim 7, wherein said bearing surface of said rod member comprises a post member which passes through said slot of said first reciprocating member, such that post member slidably contacts said first reciprocating member within said slot to effect opening and closing of said tool mechanism.

### 9. An instrument according to any one of the preceding claims, wherein said handle assembly includes a locking mechanism to lock said tool mechanism in an open or closed position.

### 10. An instrument according to any one of claims 1 to 9, wherein said tool mechanism comprises a pair of grasping members for grasping and holding tissue during surgery, and wherein said grasping members define a distal end and a proximal end in relation to said pivot point, and wherein said distal ends contact each other before said proximal ends contact each other, such that a tightening force may be progressively applied to said grasping members.

### 11. An instrument according to any one of the preceding claims, wherein said pivoting handle is provided with a pair of stop members proximate said pivot point which abut said stationary handle, a first stop member (36a) limiting opening of said handles and a second stop member (36b) limiting closing of said handles, such that the application of destructive forces to said tool mechanism is avoided during opening and closing movement.

### 12. An instrument according to any one of the preceding claims, wherein said body assembly further comprises a knob (52) (which may be the knob mentioned in claim 4 above) circumferentially secured about said outer tube member at said handle end, said knob being positioned in a slot (54) formed in said stationary handle, said knob including an extension (56) having a tubular shape with a

polygonal cross-section, such that said body assembly may be incrementally rotated in relation to said polygonal cross-section engaging an interior portion of said stationary handle.

13. An instrument according to any one of the preceding claims, wherein said handle assembly comprises two pivot points, a first pivot point being provided for pivotably connecting said pivoting handle to said stationary handle, and a second pivot point (58) being provided for securing said rod member to said pivoting handle, such that said rod member is drawn longitudinally through said outer tube member and said handle assembly with minimal radial deflection.

14. An instrument according to claim 13, wherein said second pivot point comprises two cooperating discs which surround said rod, said rod being rotatably secured between said discs.

15. An instrument according to claim 14, wherein said second pivot point comprises a pair of cooperating discs each having a post member and a bore hole for engaging the other post member; each disc further having a slot for accepting and securing an end of said rod member.

16. An instrument according to any one of preceding claims, wherein said outer tube is provided at an end remote from said handle assembly with a housing insert member having a longitudinal passage to allow said rod member to pass therethrough, said tool mechanism being pivotably secured to said housing insert member, and wherein said housing insert member is provided with a longitudinal slot adjacent said pivot point to allow said tool mechanism to pivot about said pivot point.

17. An instrument according to any one of the preceding claims, wherein said stationary handle includes an electrical connection port (42) for reception of an electrical jack member, said port electrically connecting said jack member for conducting current to said tool mechanism for cauterizing tissue during use.

18. An instrument according to claim 17, wherein said tube is electrically insulated.

19. An instrument according to claim 17 or 18, wherein said port is positioned adjacent a finger grip portion of said stationary handle, such that said port avoids obstructing view of said jaw mechanism during use.

20. An instrument according to claim 17, 18 or 19, wherein said port is positioned on said stationary handle at an angle to a longitudinal axis of said instrument in a direction away from said tube, said

angle positioning said port so as to avoid obstructing view of said jaw mechanism during use.

21. An instrument according to any one of claims 17 to 20, wherein said port is positioned at an angle to said longitudinal axis of less than 15°.

22. An instrument according to any one of the preceding claims, and as appendant to claim 4 or claim 12, wherein said knob is secured to a tubular bushing member passing through said passage, said bushing member having a passageway through which said tube passes and is secured thereto, said bushing further having a polygonal cross-section which engages an interior boss in said handle to effect a ratcheting action for incremental rotation of said jaw mechanism, and wherein said bushing has a dodecahedral cross-section.

23. An instrument as claimed in any one of the preceding claims, wherein the tool mechanism includes a pair of members (100, 102) in opposing relation, each comprising:

a plastic paddle portion having a distal end and a proximal end, and forming a land portion which opposes an opposite member of said pair, said land portion having grooves (104) therein to facilitate grasping; and

a metallic camming portion having a flat body including a pivot hole (109) and a cam slot (108), said portion further including a post member (110) to which said plastic paddle portion is integrally molded at said proximal end;

wherein said camming portion is positioned such that when said land portion is horizontal, said camming portion is substantially vertical.

24. An instrument according to claim 23, wherein said paddle portion tapers in width from said proximal end to said distal end.

25. An instrument according to claim 23, wherein said paddle portion tapers inwardly from said proximal end to a point intermediate said proximal end and said distal end, and then tapers outwardly from said intermediate point to said distal end to a rounded configuration at said distal end.

26. An instrument as claimed in any one of claims 1 to 22, wherein said tool mechanism includes a pair of scissor members (72, 74) in overlapping relation, said members each comprising:

a blade portion having a stiffening region (75) formed thereon, said stiffening region having a thickness equivalent to a thickness of said

blade portion; and

a camming portion having a body portion including a pivot hole (68) and a cam slot (76, 78), said camming member being integral with said blade portion such that said cam slot and said stiffening region are located on opposite sides of said pivot hole.

27. An instrument according to claim 26, wherein said stiffening region comprises a detent punched into said blade portion.
28. An instrument as claimed in any one of the preceding claims, wherein said pivoting handle includes a pair of stop members positioned on opposite sides of pivot point, and further wherein said stationary handle includes a pair of bosses which engage said stop members to limit rotation in each direction of said pivoting handle about said pivot point.

#### Patentansprüche

1. Endoskopisches chirurgisches Instrument umfassend:

- eine Griffeinrichtung (12) umfassend einen feststehenden Griff (14) und einen schwenkbaren Griff (16);
- einen Körperaufbau (18) umfassend ein Paar von koaxialen Elementen (20, 22), die an einem Ende an der Griffeinrichtung angebracht sind, umfassend ein inneres Stangenelement (22), das in bezug auf ein äußeres Röhrenelement (20) verschiebbar ist, wobei das Stangenelement in Antwort auf die Bewegung des schwenkbaren Griffes sich verschiebt und an einem zweiten Ende in einer Aufnahmeoberfläche (80) endet; und
- einen Werkzeugmechanismus (28) umfassend ein Paar von Werkzeugelementen, von denen zumindest eines schwenkbar an einem feststehenden Schwenkpunkt (68) an einem zweiten Ende des Röhrenelementes befestigt ist;
- worin das sich verschwenkende Werkzeugelement mit einer langgezogenen Kurvenoberfläche (76, 78) eines Kurvenschlitzes versehen ist, der in verschiebbaren Eingriff mit der Aufnahmeoberfläche des Stangenelementes ist;
- worin eine Bewegung des Schwenkgriffes das Stangenelement in bezug auf das Röhrenelement so verschiebt, daß die Aufnahmeoberfläche des Stangenelementes in Längsrichtung über der Kurvenoberfläche des Werkzeugelementes verfährt, um das Werkzeugelement zu verschwenken, um den Werkzeugmechanismus zu öffnen und zu schließen.

2. Vorrichtung gemäß Anspruch 1, worin die Werk-

zeugelemente Klemmbacken sind.

3. Vorrichtung gemäß Anspruch 1 oder 2, worin der Schwenkgriff an dem feststehenden Griff an einem Schwenkpunkt (24) angebracht ist.
4. Vorrichtung gemäß einem der vorhergehenden Ansprüche und umfassend einen drehbaren, zylinderförmigen Knopf (52), der in einem querverlaufenden Schlitz (54) angeordnet ist, der durch den feststehenden Griff (14) hindurchtritt, wobei der Knopf einen Durchtritt besitzt, durch den die Röhre (20) und die Stange (22) hindurchtreten, und der Knopf an der Röhre befestigt ist; wobei die Drehung des Knopfes eine Drehung der Röhre, der Stange und des Werkzeugmechanismus bewirkt.
5. Vorrichtung gemäß einem der vorhergehenden Ansprüche, worin die Kurvenoberfläche des Werkzeugmechanismus umfaßt einen Schlitz (76, 78) in jedem der sich hin- und herbewegenden Elemente, wobei die sich hin- und herbewegenden Elemente um einen gemeinsamen Schwenkpunkt (68) an der äußeren Röhre schwenkbar befestigt sind.
6. Vorrichtung gemäß Anspruch 5, worin die Aufnahmeoberfläche (80) des Stangenelementes umfaßt ein Zapfenelement, das durch die Schlitz der sich hin- und herbewegenden Elemente hindurchtritt, so daß das Zapfenelement in verschiebbarer Weise die sich hin- und herbewegende Elemente innerhalb der Schlitz berührt, um das Öffnen und Schließen der sich hin- und herbewegenden Elemente zu bewirken.
7. Vorrichtung gemäß Anspruch 1, 2, 3 oder 4, worin die Kurvenoberfläche umfaßt einen Schlitz in einem ersten der sich hin- und herbewegenden Elemente, wobei ein zweites der sich hin- und herbewegenden Elemente so feststehend ist, daß sich das erste Element in bezug auf das zweite Element verschwenkt.
8. Vorrichtung gemäß Anspruch 7, worin die Aufnahmeoberfläche des Stangenelementes umfaßt ein Zapfenelement, das durch den Schlitz des erst sich hin- und herbewegenden Elementes so hindurchtritt, daß das Zapfenelement in verschiebender Weise das erste sich hin- und herbewegende Element innerhalb des Schlitzes berührt, um das Öffnen und Schließen des Werkzeugmechanismus zu bewirken.
9. Vorrichtung gemäß einem der vorhergehenden Ansprüche, worin die Griffeinrichtung umfaßt einen Verriegelungsmechanismus, um den Werkzeugmechanismus in einer offenen oder geschlossenen Position zu verriegeln.

10. Vorrichtung gemäß einem der Ansprüche 1 bis 9, worin der Werkzeugmechanismus umfaßt ein Paar von Greifelementen zum Greifen und Halten von Gewebe während einer Operation, und worin die Greifelemente ein distales Ende und ein proximales Ende in bezug auf den Schwenkpunkt definieren, und worin sich die distalen Enden einander berühren, bevor sich die proximalen Enden berühren, so daß eine Festhaltekraft fortschreitend auf die Greifelemente ausgeübt werden kann. 5
11. Vorrichtung gemäß einem der vorhergehenden Ansprüche, worin der Schwenkgriff mit einem Paar von Anschlagelementen nahe dem Schwenkpunkt versehen sind, der gegen den feststehenden Griff stößt, wobei ein erstes Anschlagelement (36a) das Öffnen der Griffe und ein zweites Anschlagelement (36b) das Schließen der Griffe begrenzt, so daß das Anwenden von zerstörenden Kräften auf den Werkzeugmechanismus während der Öffnungs- und Schließbewegung vermieden wird. 10 15 20
12. Vorrichtung gemäß einem der vorhergehenden Ansprüche, worin die Körpereinrichtung weiter umfaßt einen Knopf (52) (welcher der in Anspruch 4 oben genannte Knopf sein kann), der um das äußere Röhrenelement an dem Griffende in Umfangsrichtung befestigt ist, wobei der Knopf in einem Schlitz (54) angeordnet ist, der in dem feststehenden Griff gebildet ist und der Knopf umfaßt einen Vorsprung (56) mit einer röhrenförmigen Form mit einem polygonalen Querschnitt, so daß die Körpereinrichtung schrittweise in Relation zu dem polygonalen Querschnitt in Eingriff mit einem inneren Bereich des feststehenden Griffes gedreht werden kann. 25 30 35
13. Vorrichtung gemäß einem der vorhergehenden Ansprüche, worin die Griffereinrichtung umfaßt zwei Schwenkpunkte, einen ersten Schwenkpunkt, der zum schwenkbaren Verbinden des Schwenkgriffes mit dem feststehenden Griff vorgesehen ist, und einem zweiten Schwenkpunkt (58), der zum Befestigen des Stangenelementes an dem Schwenkgriff vorgesehen ist, so daß das Stangenelement in Längsrichtung durch das äußere Röhrenelement und die Griffereinrichtung mit einer minimalen radialen Biegung gezogen wird. 40 45
14. Vorrichtung gemäß Anspruch 13, worin der zweite Schwenkpunkt umfaßt zwei zusammenwirkende Scheiben, welche die Stange umgeben, wobei die Stange drehbar zwischen den Scheiben befestigt ist. 50
15. Vorrichtung gemäß Anspruch 14, worin der zweite Schwenkpunkt umfaßt ein Paar von zusammenwirkenden Scheiben, die alle ein Zapfenelement und ein Bohrloch zum Einrücken des anderen Zapfenelementes; wobei jede Scheibe weiter einen Schlitz zur Aufnahme und Befestigung eines Endes des Zapfenelementes besitzt. 55
16. Vorrichtung gemäß einem der vorhergehenden Ansprüche, worin die äußere Röhre an einem Ende entfernt von der Griffereinrichtung mit einem Gehäuseeinsatzelement versehen ist mit einem Durchtritt in Längsrichtung, um es dem Stangenelement zu gestatten, hindurchzutreten, wobei der Werkzeugmechanismus schwenkbar an dem Gehäuseeinsatzelement befestigt ist, und worin das Gehäuseeinsatzelement mit einem längsverlaufenden Schlitz neben dem Schwenkpunkt versehen ist, um es dem Werkzeugmechanismus zu gestatten, sich um den Schwenkpunkt zu drehen.
17. Vorrichtung gemäß einem der vorhergehenden Ansprüche, worin der feststehende Griff umfaßt eine elektrische Verbindungsaufnahmeöffnung (42) zur Aufnahme eines elektrischen Steckerelementes, wobei die Aufnahmeöffnung elektrisch das Steckerelement zum Leiten von Strom zu dem Werkzeugmechanismus zum Kauterisieren von Gewebe während der Verwendung verbindet.
18. Vorrichtung gemäß Anspruch 17, worin die Röhre elektrisch isoliert ist.
19. Vorrichtung gemäß Anspruch 17 oder 18, worin die Öffnung neben einem Fingergriffbereich des feststehenden Griffes so angeordnet ist, daß die Aufnahmeöffnung das Verstellen des Blickes auf den Klemmbackenmechanismus während der Verwendung vermeidet.
20. Vorrichtung gemäß Anspruch 17, 18 oder 19, worin die Aufnahmeöffnung auf dem feststehenden Griff mit einem Winkel zur Längsachse des Instrumentes in einer Richtung weg von der Röhre angeordnet ist, wobei der Winkel, unter dem die Aufnahmeöffnung angeordnet ist, so ist, daß er das Versperren des Blickes auf den Klemmbackenmechanismus während der Verwendung vermeidet.
21. Vorrichtung gemäß einem der Ansprüche 17 bis 20, worin die Aufnahmeöffnung in einem Winkel zu der Längsachse von weniger als 15 ° angeordnet ist.
22. Vorrichtung gemäß einem der vorhergehenden Ansprüche und abhängig von Anspruch 4 oder Anspruch 12, worin der Knopf an einem röhrenförmigen Buchsenelement befestigt ist, das durch den Durchtritt hindurchtritt, wobei das Buchsenelement einen Durchtritt besitzt, durch den die Röhre hindurchtritt und an diesem befestigt ist, wobei die Buchse weiter einen polygonalen Querschnitt besitzt, der in einen inneren Ansatz an dem Griff

eingreift, um eine Klinkenwirkung zur schrittweisen Rotation des Klemmbackenmechanismus zu bewirken, und worin die Buchse einen dodekahedralen Querschnitt besitzt.

23. Vorrichtung gemäß einem der vorhergehenden Ansprüche, worin der Werkzeugmechanismus ein Paar von Elementen (100, 102) in entgegengesetzter Beziehung umfaßt, die alle umfassen:

- einen Kunststoffpaddelbereich mit einem distalen Ende und einem proximalen Ende, und die einen hervorstehenden Bereich bilden, der einem entgegengesetzten Element des Paares entgegensteht, wobei der hervorstehende Bereich Nuten (104) darin besitzt, um das Greifen zu erleichtern; und
- einen metallischen Kurvenbereich mit einem flachen Körper umfassend ein Schwenkloch (109) und einen Kurvenschlitz (108), wobei der Bereich weiter umfaßt ein Zapfenelement (110), an das der Kunststoffpaddelbereich einstückig an das proximale Ende gegossen ist;
- worin der Kurvenbereich so angeordnet ist, daß, wenn der vorstehende Bereich horizontal ist, der Kurvenbereich im wesentlichen vertikal ist.

24. Vorrichtung gemäß Anspruch 23, worin der Paddelbereich sich bezüglich seiner Breite von dem proximalen Ende zu dem distalen Ende verjüngt.

25. Vorrichtung gemäß Anspruch 23, worin sich der Paddelbereich von dem proximalen Ende zu einem Punkt zwischen dem proximalen Ende und dem distalen Ende verjüngt und dann sich nach außen von dem Zwischenpunkt zu dem distalen Ende zu einer abgerundeten Gestalt an dem distalen Ende verjüngt.

26. Vorrichtung gemäß einem der Ansprüche 1 bis 22, worin der Werkzeugmechanismus umfaßt ein Paar von Scherenelementen (72, 74) in überlappender Beziehung, wobei die Elemente alle umfassen:

- einen Schneidenbereich mit einem Versteifungsbereich (75), der darauf gebildet ist, wobei der Versteifungsbereich eine Dicke äquivalent zu einer Dicke des Schneidenbereiches besitzt; und
- einen Kurvenbereich mit einem Körperbereich umfassend ein Schwenkloch (68) und einen Kurvenschlitz (76, 78), wobei das Kurvenelement einstückig mit dem Schneidenbereich so gebildet ist, daß der Kurvenschlitz und der Versteifungsbereich auf entgegengesetzten Seiten des Schwenkloches angeordnet sind.

27. Vorrichtung gemäß Anspruch 26, worin der Verstei-

fungsbereich umfaßt einen Vorsprung, der in den Schneidenbereich gestanzt ist.

28. Vorrichtung gemäß einem der vorhergehenden Ansprüche, wobei der Schwenkgriff umfaßt ein Paar von Anschlagelementen, die auf entgegengesetzten Seiten des Schwenkpunktes angeordnet sind, und weiterhin wobei der feststehende Griff umfaßt ein Paar von Ansätzen, die in Eingriff mit den Anschlagelementen treten, um die Rotation in jeder Richtung des Schwenkgriffes um den Schwenkpunkt zu begrenzen.

## Revendications

1. Instrument chirurgical endoscopique comprenant :

un assemblage de poignées (12) comprenant une poignée stationnaire (14) et une poignée pivotante (16);

un assemblage de corps (18) comprenant une paire d'éléments coaxiaux (20, 22) attachés à une extrémité audit assemblage de poignées, comprenant un élément de tige interne (22) coulissant par rapport à un élément de tube externe (20), ledit élément de tige coulissant en réponse au mouvement de ladite poignée pivotante et se terminant à une seconde extrémité par une surface d'appui (80); et

un mécanisme d'outil (28) comprenant une paire d'éléments d'outils dont l'un au moins est fixé pivotant à un point stationnaire de pivot (68) à une seconde extrémité dudit élément de tube;

dans lequel ledit élément d'outil pivotant est muni d'une surface allongée de came (76, 78) d'une fente de came qui s'engage de manière coulissante avec ladite surface d'appui dudit élément de tige;

dans lequel le mouvement de ladite poignée pivotante fait coulisser ledit élément de tige par rapport audit élément de tube, de façon que ladite surface d'appui dudit élément de tige coulisse longitudinalement sur ladite surface de came dudit élément d'outil pour faire pivoter ledit élément d'outil afin d'ouvrir et de fermer ledit mécanisme d'outil.

2. Instrument selon la revendication 1, dans lequel les éléments d'outil sont des mâchoires.

3. Instrument selon la revendication 1 ou 2, dans lequel la poignée pivotante est attachée à la poignée stationnaire à un point de pivot (24).

4. Instrument selon l'une des revendications précédentes, et comprenant un bouton rotatif de forme cylindrique (52) positionné dans une fente transversale (54) qui passe à travers ladite poignée station-

naire (14), ledit bouton ayant un passage à travers lequel ledit tube (20) et ladite tige (22) passent, ledit bouton étant fixé audit tube; dans lequel la rotation dudit bouton réalise la rotation dudit tube, de ladite tige et du mécanisme d'outil.

5. Instrument selon l'une des revendications précédentes, dans lequel ladite surface de came dudit mécanisme d'outil comprend une fente (76, 78) dans chacun desdits éléments alternatifs, lesdits éléments alternatifs étant pivotants autour d'un point de pivot commun (68) fixé audit tube externe. 5
6. Instrument selon la revendication 5, dans lequel ladite surface d'appui (80) dudit élément de tige comprend un élément de colonne qui passe à travers lesdites lentes desdits éléments alternatifs, de façon que ledit élément de colonne vienne en contact coulissant avec lesdits éléments alternatifs dans lesdites lentes pour effectuer l'ouverture et la fermeture desdits éléments alternatifs. 10
7. Instrument selon l'une des revendications 1 à 4, dans lequel ladite surface de came comprend une lente dans un premier élément desdits éléments alternatifs, un second élément desdits éléments alternatifs étant stationnaire de façon que ledit premier élément pivote par rapport audit second élément. 20
8. Instrument selon la revendication 7, dans lequel ladite surface d'appui dudit élément de tige comprend un élément de colonne qui passe à travers ladite fente dudit premier élément alternatif, de façon que ledit élément de colonne vienne en contact coulissant avec ledit premier élément alternatif dans ladite lente pour effectuer l'ouverture et la fermeture dudit mécanisme d'outil. 25
9. Instrument selon l'une des revendications précédentes, dans lequel ledit assemblage de poignée comprend un mécanisme de verrouillage pour verrouiller ledit mécanisme d'outil dans une position ouverte ou fermée. 30
10. Instrument selon l'une des revendications 1 à 9, dans lequel ledit mécanisme d'outil comprend une paire d'éléments de préhension pour saisir et tenir le tissu pendant la chirurgie, et dans lequel lesdits éléments de préhension définissent une extrémité distale et une extrémité proximale par rapport audit point de pivot, et dans lequel lesdites extrémités distales viennent en contact l'une avec l'autre avant que lesdites extrémités proximales viennent en contact l'une avec l'autre, de façon qu'une force de serrage puisse être progressivement appliquée auxdits éléments de préhension. 35
11. Instrument selon l'une des revendications précé-

dentes, dans lequel ladite poignée pivotante est munie d'une paire d'éléments de butée d'arrêt à proximité dudit point de pivot qui viennent en butée avec ladite poignée stationnaire, un premier élément de butée d'arrêt (36a) limitant l'ouverture desdites poignées et un second élément de butée d'arrêt (36b) limitant la fermeture desdites poignées, de façon que l'application de forces destructives audit mécanisme d'outil est évitée pendant le mouvement d'ouverture et de fermeture.

12. Instrument selon l'une des revendications précédentes, dans lequel ledit assemblage de corps comprend en outre un bouton (52) (qui peut être le bouton mentionné à la revendication 4 ci-dessus) circonférentiellement fixé autour dudit élément de tube externe à ladite extrémité de poignée, ledit bouton étant positionné dans une lente (54) formée dans ladite poignée stationnaire, ledit bouton comprenant une saillie (56) ayant une forme tubulaire avec une section transversale polygonale, de façon que ledit assemblage de corps puisse être pivoté incrémentiellement par rapport à ladite section transversale polygonale s'engageant dans une portion intérieure de ladite poignée stationnaire. 40
13. Instrument selon l'une des revendications précédentes, dans lequel ledit assemblage de poignées comprend deux points de pivot, un premier point de pivot étant prévu pour connecter de manière pivotante ladite poignée pivotante à ladite poignée stationnaire, et un second point de pivot (58) étant prévu pour fixer ledit élément de tige à ladite poignée pivotante, de façon que ledit élément de tige soit tiré longitudinalement à travers ledit élément de tube externe et ledit assemblage de poignée avec une déformation radiale minimale. 45
14. Instrument selon la revendication 13, dans lequel ledit second point de pivot comprend deux disques coopérants qui entourent ladite tige, ladite tige étant fixée rotative entre lesdits disques. 50
15. Instrument selon la revendication 14, dans lequel ledit second point de pivot comprend une paire de disques coopérants ayant chacun un élément de colonne et un trou d'alésage pour engager l'autre élément de colonne; chaque disque ayant en outre une lente pour accepter et fixer une extrémité dudit élément de tige. 55
16. Instrument selon l'une des revendications précédentes, dans lequel ledit tube externe est muni à une extrémité éloignée dudit assemblage de poignée d'un élément d'insert de logement ayant un passage longitudinal pour permettre audit élément de tige de passer à travers celui-ci, ledit mécanisme d'outil étant fixé pivotant audit élément d'insert de



logement, et dans lequel ledit élément d'insert de logement est muni d'une lente longitudinale adjacente audit point de pivot pour permettre audit mécanisme d'outil de pivoter autour dudit point de pivot.

5

17. Instrument selon l'une des revendications précédentes, dans lequel ladite poignée stationnaire comprend une borne de connexion électrique (42) pour la réception d'un élément de vérin électrique, ladite borne reliant électriquement ledit élément de vérin pour conduire le courant audit mécanisme d'outil pour cautériser le tissu en service. 10
18. Instrument selon la revendication 17, dans lequel ledit tube est électriquement isolé. 15
19. Instrument selon la revendication 17 ou 18, dans lequel ledit orifice est positionné adjacent à une portion de préhension de doigt de ladite poignée stationnaire, de façon que ladite borne évite d'obstruer la vue dudit mécanisme de mâchoire en service. 20
20. Instrument selon l'une des revendications 17 à 19, dans lequel ladite borne est positionnée sur ladite poignée stationnaire avec un angle par rapport à l'axe longitudinal dudit instrument dans une direction s'éloignant dudit tube, ledit angle positionnant ladite borne de façon à éviter l'obstruction de la vue dudit mécanisme de mâchoires en service. 25 30
21. Instrument selon l'une des revendications 17 à 20, dans lequel ladite borne est positionnée avec un angle par rapport audit axe longitudinal de moins de 15°. 35
22. Instrument selon l'une des revendications précédentes et dépendant de la revendication 4 ou 12, dans lequel ledit bouton est fixé à un élément tubulaire de manchon passant à travers ledit passage, ledit élément de manchon ayant un passage à travers lequel ledit tube passe et est fixé à celui-ci, ledit manchon ayant en outre une section transversale polygonale qui engage un bossage intérieur dans ladite poignée pour effectuer une action d'encliquetage pour la rotation incrémentielle dudit mécanisme de mâchoire, et dans lequel ledit manchon a une section transversale dodécaédrique. 40 45 50
23. Instrument selon l'une des revendications précédentes, dans lequel le mécanisme d'outil comprend une paire d'éléments (100, 102) opposés l'un à l'autre, chacun comprenant : 55  
une portion de palette plastique ayant une extrémité distale et une extrémité proximale, et formant une portion de champ qui est opposée à un élément opposé de ladite paire, ladite por-

tion de champ ayant des rainures (104) dans celle-ci pour faciliter la préhension; et une portion de came métallique ayant un corps plat comprenant un trou de pivot (109) et une lente de came (108), ladite portion comprenant en outre un élément de colonne (110) auquel ladite portion de palette plastique est moulée intégralement à ladite extrémité proximale; dans lequel ladite portion de came est positionnée de façon que lorsque ladite position de champ est horizontale, ladite portion de came est substantiellement verticale.

24. Instrument selon la revendication 23, dans lequel ladite portion de palette s'amincit en largeur à partir de ladite extrémité proximale vers ladite extrémité distale.
25. Instrument selon la revendication 23, dans lequel ladite portion de palette s'amincit vers l'intérieur à partir de ladite extrémité proximale vers un point intermédiaire entre ladite extrémité proximale et ladite extrémité distale, et puis s'amincit vers l'extérieur à partir dudit point intermédiaire vers ladite extrémité distale vers une configuration arrondie à ladite extrémité distale.
26. Instrument selon l'une des revendications 1 à 22, dans lequel ledit mécanisme d'outil comprend une paire d'éléments de ciseaux (72, 74) se chevauchant l'un l'autre, lesdits éléments comprenant chacun :  
une portion de lame ayant une région de raidissement (75) formée sur celle-ci, ladite région de raidissement ayant une épaisseur équivalente à une épaisseur de ladite portion de lame; et  
une portion de came ayant une portion de corps comprenant un trou de pivot (68) et une lente de came (76, 78), ledit élément de came étant d'une seule pièce avec ladite portion de lame de façon que ladite lente de came et ladite région de raidissement soient situées sur des côtés opposés dudit trou de pivot.
27. Instrument selon la revendication 26, dans lequel ladite région de raidissement comprend un cran poinçonné dans ladite portion de lame.
28. Instrument selon l'une des revendications précédentes, dans lequel ladite poignée pivotante comprend une paire d'éléments de butée d'arrêt positionnés sur des côtés opposés du point de pivot, et en outre dans lequel ladite poignée stationnaire comprend une paire de bossages qui viennent en contact avec lesdits éléments de butée d'arrêt pour limiter la rotation dans chaque direction de ladite poignée pivotante autour dudit point de pivot.

Fig.1

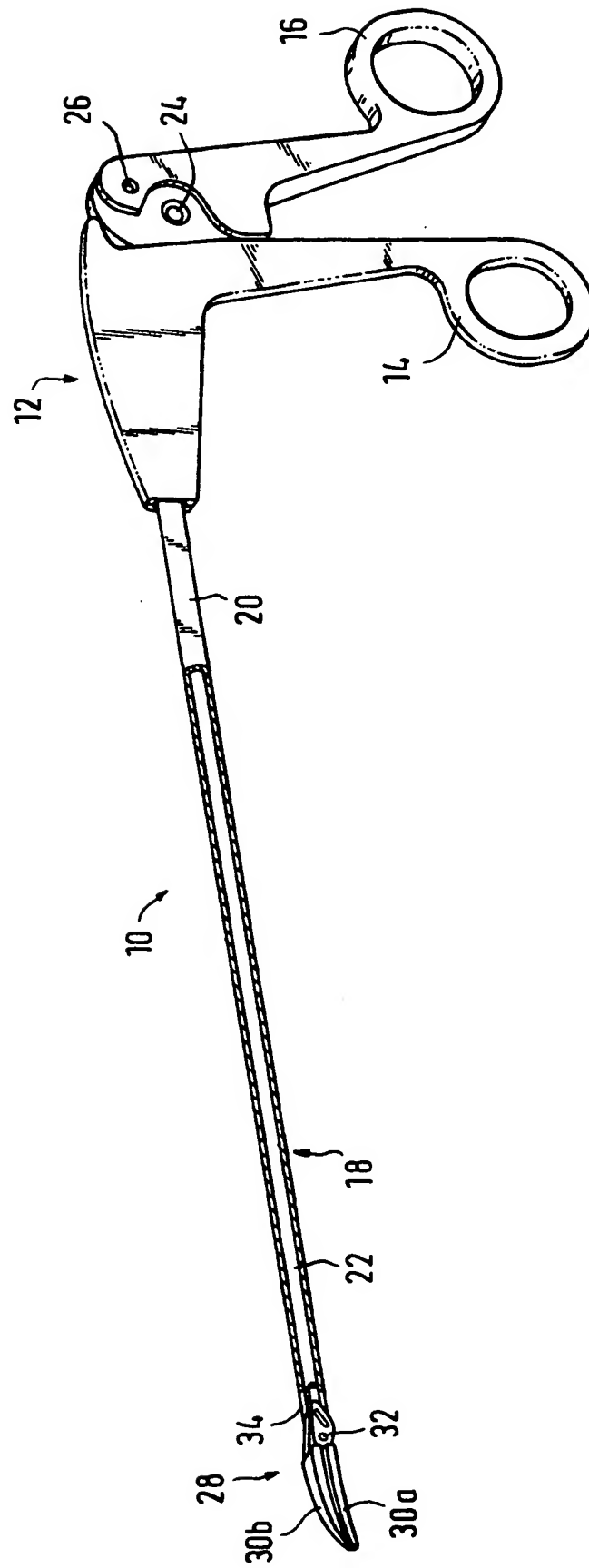


Fig. 2

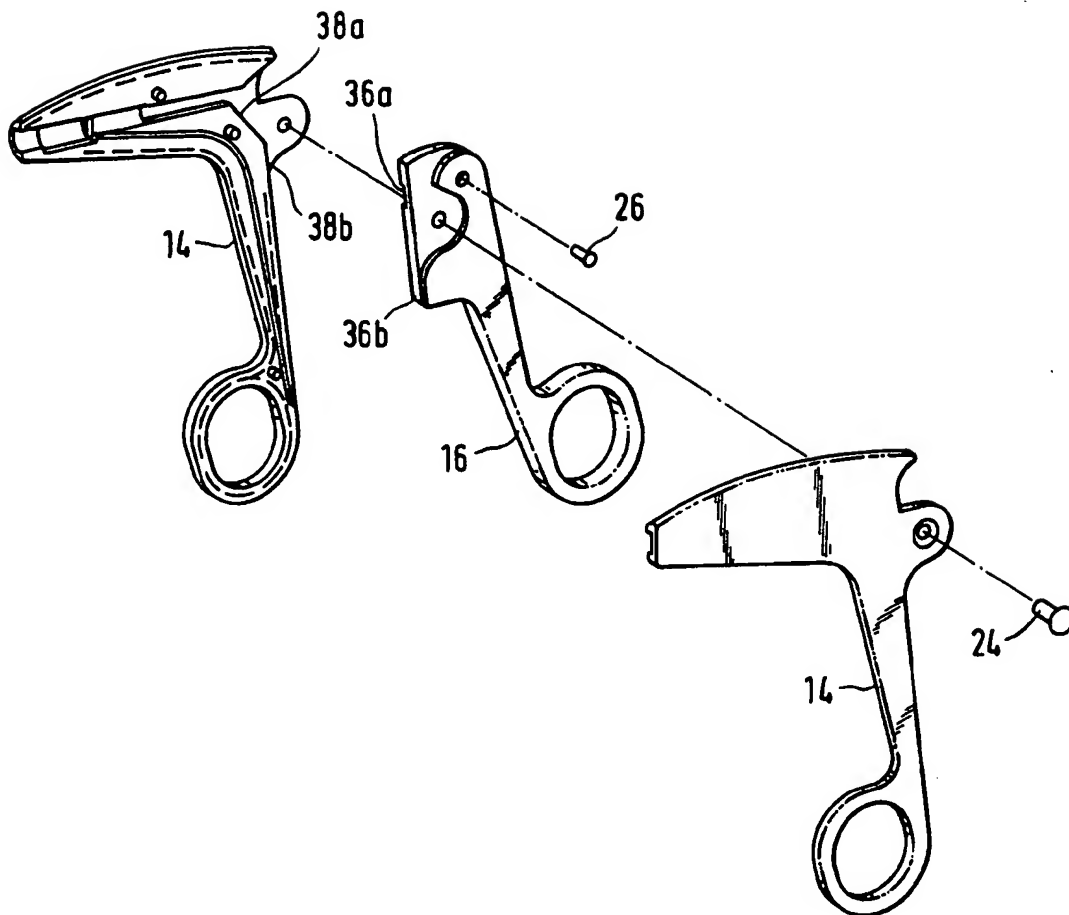
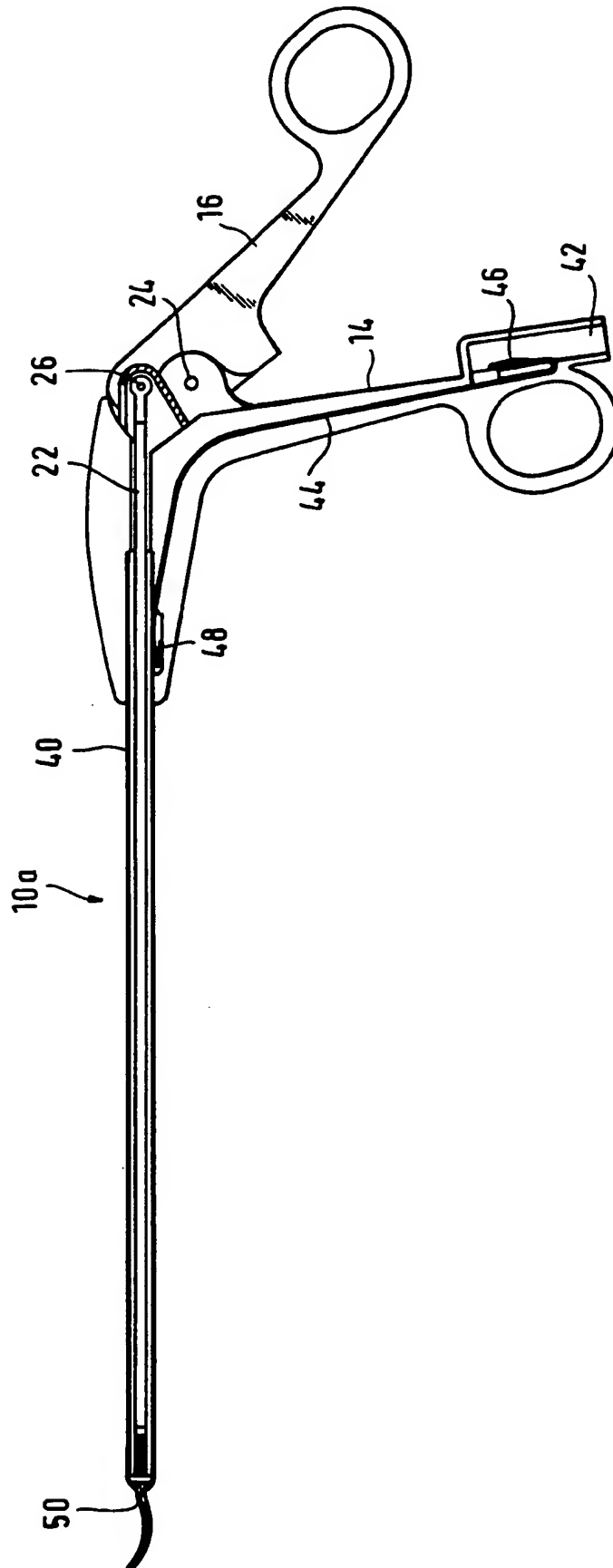


Fig. 3



**Fig. 4**

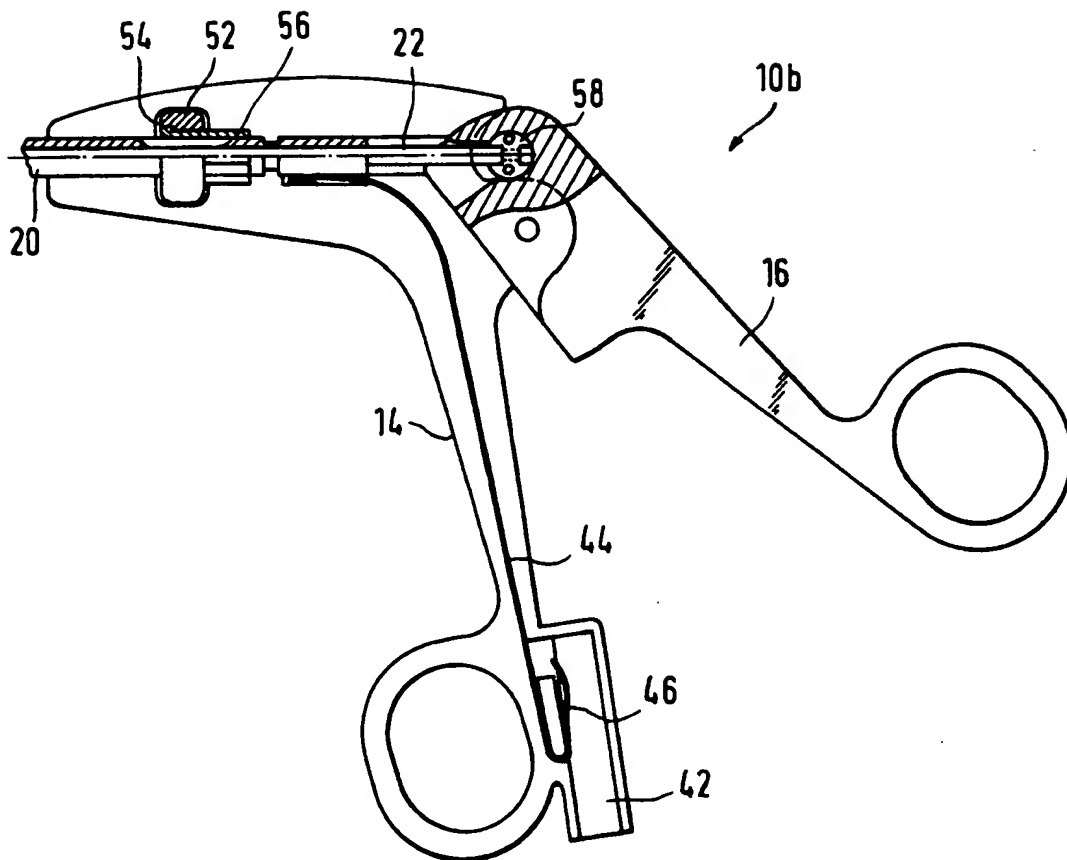


Fig. 5

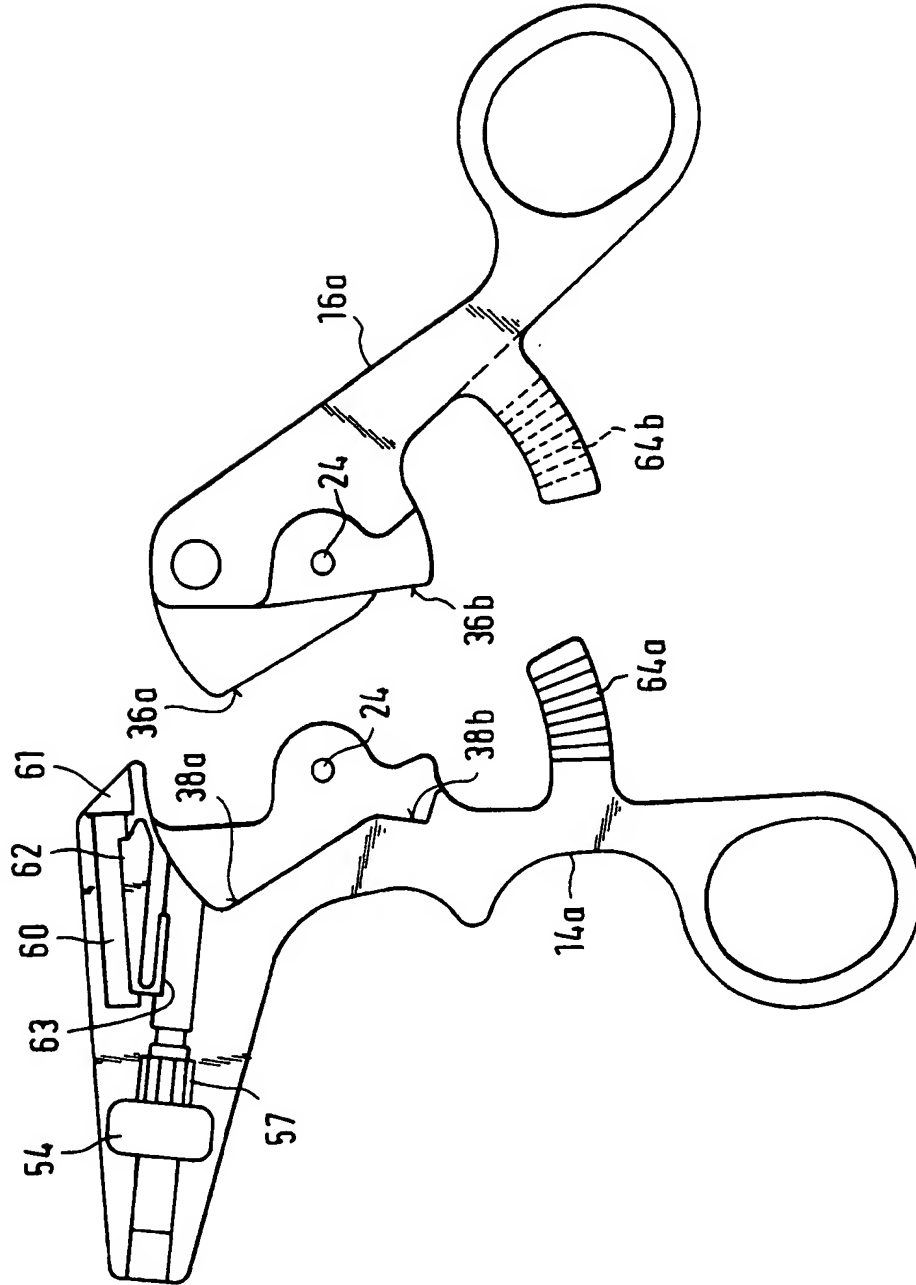




Fig. 6A

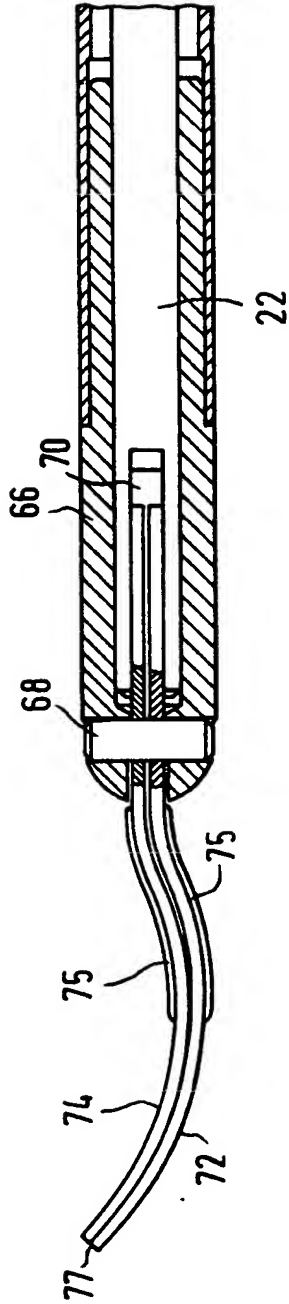


Fig. 6B

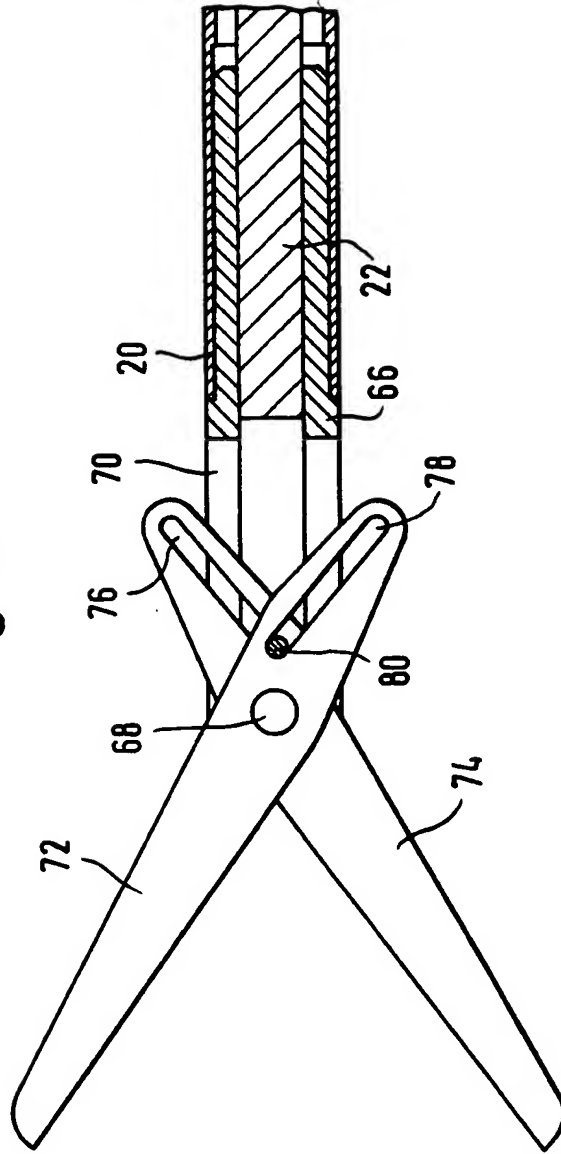


Fig. 7

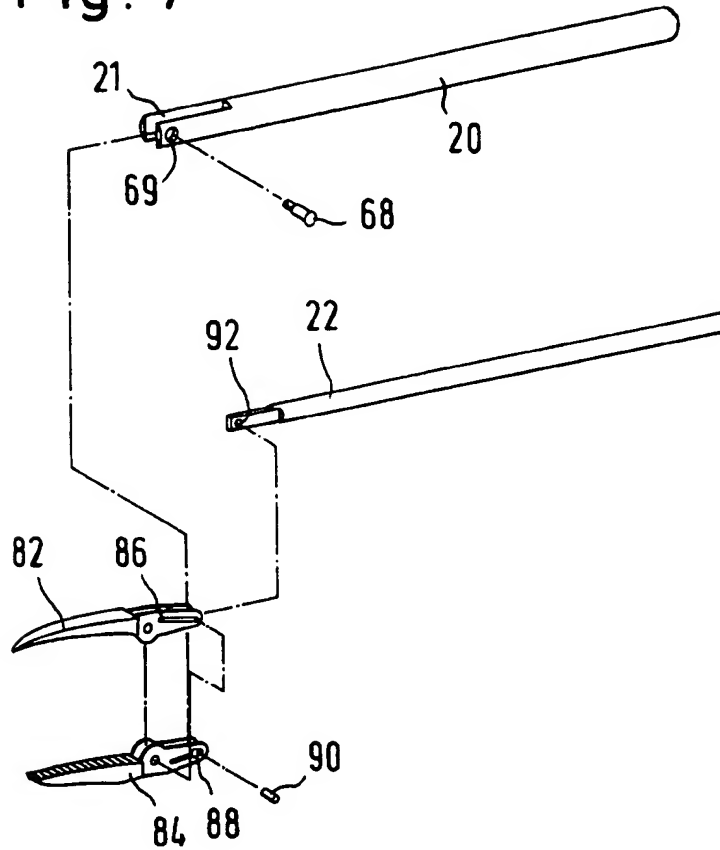


Fig.8A

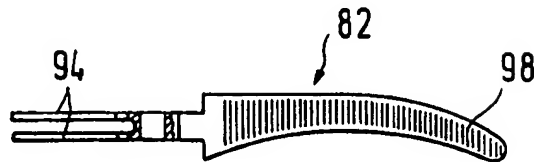


Fig.8B

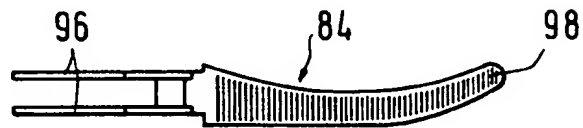


Fig.9

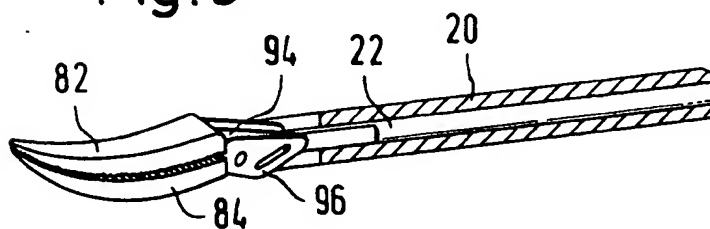


Fig.10A

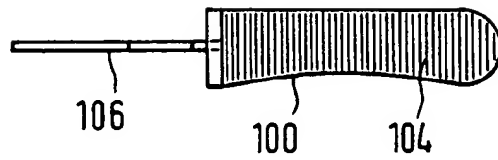


Fig.10B

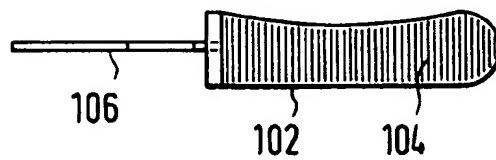


Fig.10 C

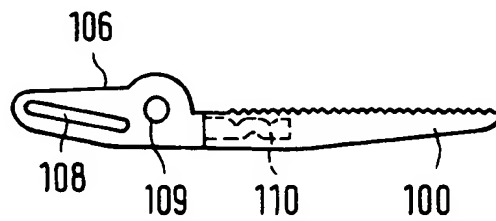


Fig.10 D

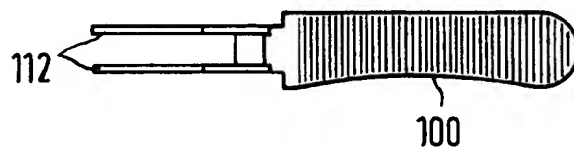


Fig.10E

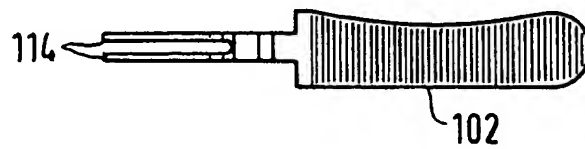


Fig. 11A

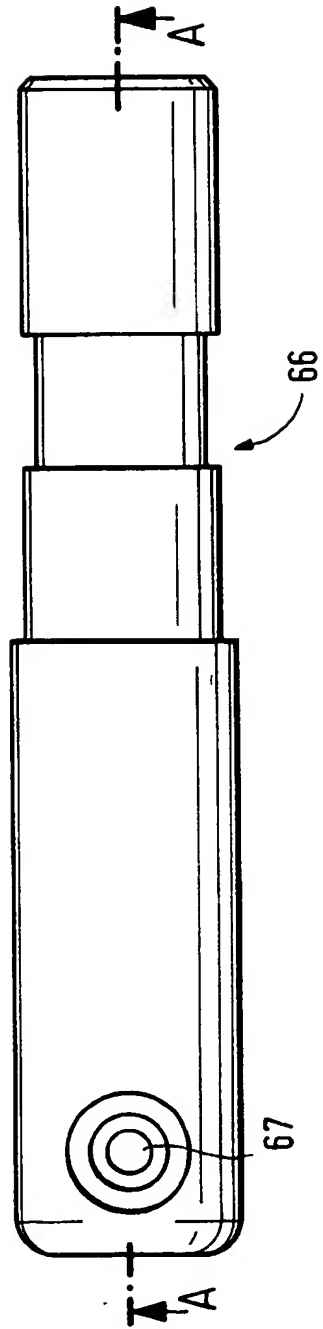


Fig. 11B

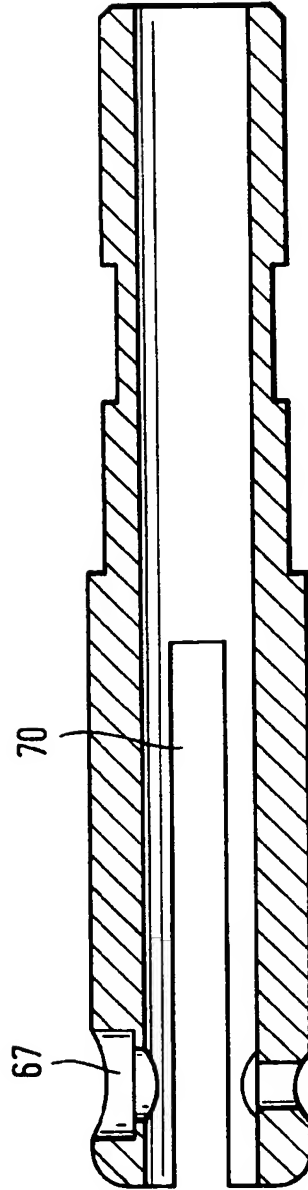


Fig.12A

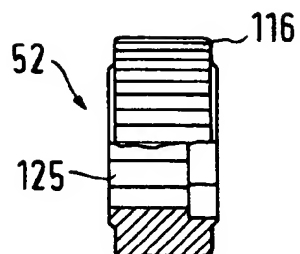


Fig.12B

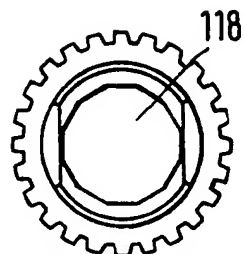


Fig.13A

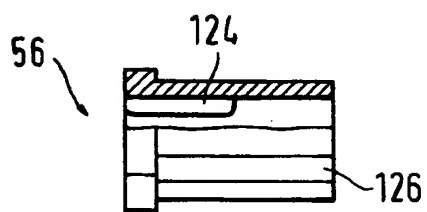


Fig.13B

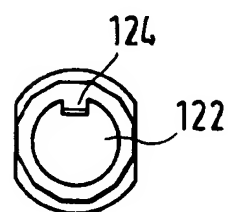


Fig.14A

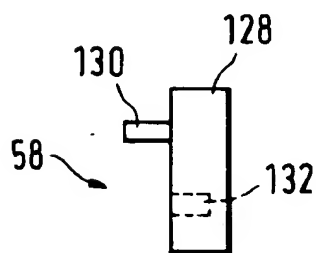


Fig.14B

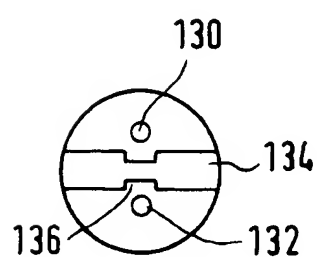


Fig.15 A

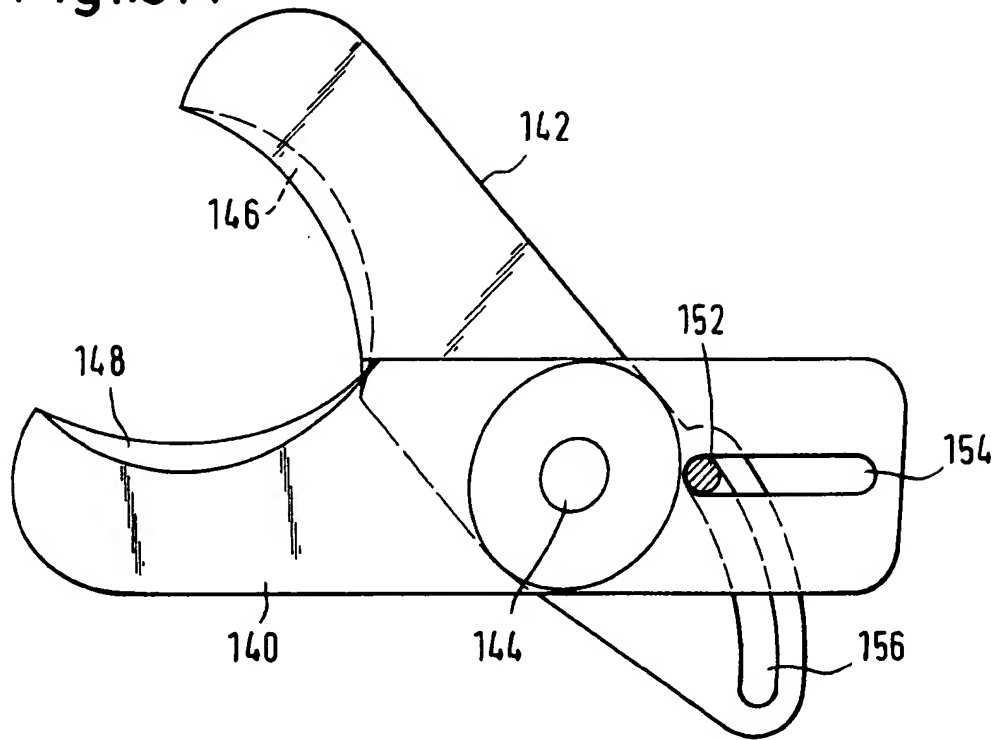


Fig.15 B

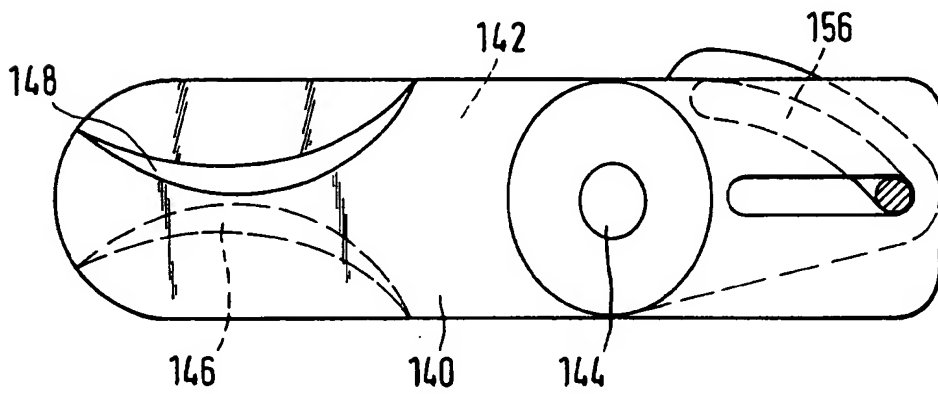


Fig.15C

